

Sound calibrators – new revised edition of IEC 60942

By Susan Dowson

Background

Edition 4 of the international specification standard for sound calibrators, IEC 60942, has just been published [1], replacing edition 3 published in 2003 [2]. This article explains the main differences between the two editions and the impact these changes will have on the user.

Sound calibrators are in very widespread use by anyone making a measurement using a sound level meter or microphone. They are designed to produce a known sound pressure level, or levels, at a known frequency, or frequencies. As such they are used primarily in checking or adjusting the overall sensitivity of acoustical measuring devices or systems, but can also be used to determine the pressure sensitivity of a microphone. 'Sound calibrator' is a generic term covering electronic devices as well as pistonphones – for the latter the sound pressure is generated in a fixed air volume by the motion of one or more pistons.

Standardisation process

For most acoustical instruments the specifications are given in international standard documents produced by the International Electrotechnical Commission (IEC), with the relevant committee being IEC/TC29 'Electroacoustics'. This committee is paralleled by a UK National Committee, BSI/EPL29 within the British Standards Institution. Under IEC/TC29 there are a number of specific groups - Working Groups (WG), who are working on new documents, or Maintenance Teams (MT) who are mainly revising existing standards. The group responsible for sound calibrators is MT17 which has 17 countries registered as members, including the UK, and it is this MT that has revised the 2003 edition of the IEC 60942 standard. The UK generally accepts all the standards from IEC/TC29 without change and publishes them as BS EN versions, for example, the 2003 edition was dual-numbered as BS EN 60942:2003 [3] with identical content to the IEC

version. There are many benefits with this approach - IEC/TC29 in common with other IEC committees has global membership and it is clearly beneficial for manufacturers, suppliers and users for there to be just one standard giving specifications for a particular device.

The updated text for the new edition 4 of the sound calibrator standard has now completed the full preparation stages required by IEC and has successfully passed the

voting process with 100% of the countries recording a positive vote, and it has been published as IEC 60942:2017. In due course it is expected that the UK will adopt this standard without change and issue it as BS EN 60942: Ed. 4.

Key differences between the 2017 Ed. 4 and the 2003 Ed. 3 of IEC 60942

The 2017 edition of the standard is similar to the 2003 edition in that it covers the specifications for the sound calibrator, has an Annex that gives detailed tests for Pattern Evaluation testing of models of instrument, such as would be requested by the manufacturer of the sound calibrator, and an Annex that gives details of Periodic tests relevant to a particular specimen of sound calibrator. Periodic testing would be requested by the user of the calibrator, and typically within the UK such services are provided by laboratories accredited by the United Kingdom Accreditation Service (UKAS).

However, there are several significant technical changes between the 2017 and 2003 editions of the standard of which the manufacturer, calibration/testing laboratories and users need to be aware.

The main changes are listed below:

1. Changes to class designations

Specifications continue to be included in edition 4 for three classes of sound calibrator, class LS - normally only used within the laboratory, and class 1 and class 2 considered as sound calibrators for field use. Acceptance limits (see below) are smallest for class LS and largest for class 2 instruments. Detailed changes to the class designations are:

- Deletion of the class designations class LS/C, class 1/C and class 2/C; in the 2003 edition class LS/C and class 1/C were the designations for those sound calibrators that required corrections for static pressure to meet the performance class. Corrections for ambient temperature and ambient relative humidity were not permitted. Class 2/C was the designation for a class 2 sound calibrator that required corrections for any of static pressure, ambient temperature or ambient relative humidity to meet the performance class.

These corrections were to be applied, usually manually, to ensure the sound calibrator met the specifications of the standard. It has now been decided that with modern-day electronic circuitry such corrections are no longer required (and many people did not apply them either!). This means that no corrections are permitted for any of the environmental parameters, so class LS, class 1 and class 2 sound calibrators must meet the specifications given in the standard with no corrections applied. This is a much more straightforward approach and means there is now no need for the user to worry about the effect of environmental conditions on the performance of their sound calibrator, unless it is a pistonphone.



- pistonphones, due to their mechanical principle of operation do of course require corrections to be applied for the static pressure, so two further class designations, class LS/M and class 1/M have been added in edition 4 of the standard, specifically for pistonphones; this means that pistonphones which are designated class LS/M and/or class 1/M depending on their performance are permitted corrections for static pressure but not for any other environmental parameter. 'M' denotes a Mechanical principle of operation.

The following table shows the different class designations described in the 2017 Ed. 4 and 2003 Ed. 3 of IEC 60942, but note this does not necessarily show any direct equivalence of particular classes as other specifications vary between the two editions:

Sound calibrator class designations – comparison of IEC 60942 2017 and 2003 editions

Class designation	IEC 60942:2017 Ed. 4	IEC 60942:2003 Ed. 3
LS	✓	✓
LS/C	X	✓
LS/M	✓	X
1	✓	✓
1/C	X	✓
1/M	✓	X
2	✓	✓
2/C	X	✓
Key: ✓ – class included in edition, X – class not included in edition		

2. Amended conformance criteria

In common with other IEC/TC29 standards the 2017 edition of IEC 60942 includes new simplified criteria to demonstrate conformance to the specification of the standard - conformance is now demonstrated when (a) measured deviations from design goals do not exceed the applicable acceptance limits and (b) the uncertainty of measurement does not exceed the corresponding maximum-permitted uncertainty. So, the standard now gives separate acceptance limits, particularly relevant to manufacturers for their design and to users, and also separate maximum permitted uncertainties of measurement for a coverage probability of 95%, relevant particularly to calibration and testing laboratories. In the 2003 edition specifications were in terms of tolerance limits which included the expanded uncertainty of measurement, so the new approach is much clearer.

Two additional Annexes are included in edition 4 – one explaining the new approach to conformance in terms of the relationship between tolerance interval, corresponding acceptance interval and the maximum permitted uncertainty of

measurement and one giving useful examples of assessments of conformance to the specifications of the standard.

3. Short-term level fluctuation test

This test has been modified, to improve and make more meaningful the measurement of sound pressure level stability, by considering the mean sound pressure level, and the maximum and minimum levels generated over a period of 60s of operation. This test is performed for pattern evaluation only.

4. Change to some environmental test conditions


Some of the environmental tests to be performed during pattern evaluation have been amended to make them more practical, to avoid icing being produced, which was possible under the tests described in the 2003 edition. This is particularly relevant for the tests of the influence on the sound calibrator of specified combinations of temperature and relative humidity at air temperatures of -10 °C, 5 °C and 0 °C.

5. Addition of an alternative test for immunity to radio-frequency fields

The test for immunity to radio-frequency fields, again to be performed during pattern evaluation testing, has been amended to include an alternative test method using transverse electromagnetic (TEM) waveguides. The requirements for the TEM waveguides and the methods of implementing the testing are described in the more generic emc standards.

How will adoption of IEC 60942 Ed. 4 affect the user?

The changes in edition 4 of IEC 60942 have considerably simplified use of a sound calibrator. The major benefit is that the user will no longer need to apply corrections for ambient environmental conditions, other than for static pressure if using a pistonphone, with the knowledge that within the range of environmental conditions given in the standard the sound calibrator is meeting the specifications. Also, the simplification of the conformance criteria means it is easy for a user to look at the standard and know the acceptance limits around the design goal, a philosophy that also simplifies the approach for manufacturers at the design stage.

As the manufacturers transition from selling devices manufactured to the 2003 edition to new devices manufactured to the 2017 edition of the standard the main change of which users should be aware is the different class designations – for the 2017 edition these classes are class LS, class 1 and class 2, and for pistonphones class LS/M and class 1/M. 

References

- [1] IEC 60942:2017, Electroacoustics - Sound calibrators
- [2] IEC 60942:2003, Electroacoustics - Sound calibrators
- [3] BS EN 60942: 2003, Electroacoustics - Sound calibrators

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